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MOUNT ROAD, SPENCER AND CO., MADRAS.

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EDITORIAL NOTES.

ATTEMPTS to record the colours in nature by means of photography have been made at various times with indifferent success and we wish to direct the attention of our readers to the extract from *Nature* which is published further on, describing M. Lippmann's method, which may be said to be the most scientific as well as the simplest and most practical method of colour photography as yet promulgated. M. Lippmann's colour photographs were exhibited some years ago, and last month this French *savant* gave a lecture and demonstration at the Royal Society of London, where he explained his invention before an audience of the most distinguished scientific men. He prefaced the description of his own method by a historical resumé, giving Becquerel the credit of the first serious work in this direction. The results obtained by Becquerel were not permanent as they could not be fixed, and so they were only available in a dark room. Next followed work on three-colour photography, and this included the methods of Clerk Maxwell and of Ducos du Hauron. The fact of three separate negatives having to be taken, and the employment of pigments, left these methods short of the ideal. We lately published a paper by Mr. R. Ll. Jones, explaining a more recent method of colour photography, that of Dr. Joly, by the employment of ruled screens. M. Lippmann's method necessitates only one exposure, any sensitive film which is sufficiently transparent can be used, and development is performed in the ordinary way. The only addition to the dark slide is a mercurial backing which should, during the exposure, be in contact with the film so as to act as a mirror. The exposure is made with the glass side towards the lens, and after development and fixing of the negative, a dark backing is put on and the photograph is viewed by reflected light. When the plate is held so that the light falls upon it at the proper angle, the picture will be seen in its natural colours. For a fuller account and explanation of the method we must refer the reader to our "Extracts" columns. Should any of our members try the method, we trust that a report with the results will be communicated to the Society.

THE adoption in England of the Metric System of weights and measures has again received a check, the leader of the House of Commons having recently stated that the introduction of the change by legislation was outside the scope of practical politics. England and America are almost the only countries in the world which do not use this system, but in America a bill on the subject is before the House of Representatives of the United States. There is much to be said in favour intrinsically of a duodenary system *versus* a decimal system; but to the ordinary work-a-day photographer at least, the latter system which brings uniformity between the arithmetical system and the system of measures would be of far greater convenience.

THE Society's First Half-yearly Competition for this year, recently closed, was an unusually small one, and it is remarkable for the fact that this is (we believe) the first competition at which no enlargements have been entered. The hot weather in the Madras Presidency, with the air temperatures in the shade at 110° Fahr. and the tap water at 96° Fahr., is not just the sort of thing to stimulate the photographer. Our friends at home, who are glad to secure the warmth of a cozy cupboard to work in and a kettle of hot-water with which to raise the temperature of the developer, can never realise the troubles of his exiled fellow worker. Let him imagine the enthusiastic amateur who, because he feels that he is bound to send something to a competition, even just to make a show of some sort, ventures to his dark room, where the temperature is 98° or 100° Fahr. He walks there in the lightest of raiments, and the door having been secured he does not overburden his perspiring frame with more raiment than is necessary to prevent his blood from freezing within him; in fact he finds it quite soothing to remove all obstacles which are in the way of the atmosphere coming into close relation with his blood—indeed he would even strip his skin if he could. Having prepared himself for a Turkish bath, he proceeds to make up his developer with water which is distinctly tepid to the touch. As development proceeds he finds that the film is getting soft, with some brands of plates he discovers a bit of clear glass in the developing dish and the gelatine film diffused in flakes through the developing solution. Even with plates that are not in the habit of giving one the slip in this fashion, the operator finds that he cannot keep the plate long in the warm alkaline developer, and wash off he must, then immerse in alum or formalin, otherwise the negative is ruined and love's labour lost. This is we feel sure quite an ordinary case, and the experiences of the photographer in the Tropics would rend the hearts of his sisters and his cousins and his aunts at home. Well, under such circumstances we have come to the conclusion that the practice of photography in the hot weather is certainly akin to lunacy. We dwell upon this aspect of the subject because we believe that it would be better either to give up the hot weather competition altogether, or to hold it at some other time of year. Suggestions from members would, we doubt not, be welcomed.

To turn now to the exhibits themselves. Although the numbers are small, yet many of them bear distinct evidence of thought and much labour well spent. We have no dissent to enter from the Judges' awards, which we think could hardly have been given in any other way. After saying that, we would add that we cannot smother the wish that some more tangible recognition had been made of one set of exhibits, which are a departure from routine and show decided merit in the treatment of some of the subjects. We refer to Mr. Pinsent's exhibits, which the Judges rejected for a technical defect, viz., "printing," an operation attended with uncertain results in the case of gelatino-chloride papers in the recent excessively hot weather. Mr. Pinsent has boldly attempted the portrayal of the human form, a most difficult subject at any time, and he has attained a fair measure of success. This alone we think was sufficient to merit a certificate at least. With models so handy it is surprising that photographers here have not more often attempted the partially draped figure. Mr. Pinsent deserves encouragement and we hope to see more of his work, but he will find that in order to produce the most artistic results he must also perfect his technique in development and printing. We do not care for the posing of 'Dorothy' or of 'Norma'—it is in both too artificial. "Maiden Meditation" would be much improved by cutting away three-eighths of an inch of the bottom of the picture—try it! "Mahroussa" and "Seta" have the elements of a good picture, but they are both spoiled, the former by too much and the latter by too little drapery. "The Orphan" is by a great way the best of the series: the posing and the expression are excellent, but the picture is flat and wants lighting. It would be very well worth doing over again, and we should like to reproduce the result in the Journal.

H.H. Prince Rama Vurmah's "A Promenade" is well conceived, but it is ruined by the model bull dog in clay placed in the foreground, while the print is also flat; his other two exhibits need no comment, as they are not equal to His Highness's average work.

Mr. Maennig's "Tea Party" has not been improved by the vignetting at the top, which now has the appearance of a mist descending upon the party. The arrangement is too symmetrical and there is a look of "each one for himself" which does not contribute towards that

harmony and unification which one expects not only in a picture but also at "a tea party." The "Portrait" is much handicapped by the background, and we would recommend cutting away $1\frac{1}{4}$ inches of the top and enough of the sides to match the height of the cut down print.

Mr Blaker's "The First Shot" is a capital subject, but there are too many figures in it which distract the eye from the principal subject. Personally we would much prefer $2\frac{1}{2}$ inches of the right side of the picture cut clean away, and the rest will make a far more effective picture—the principal figure will then be in its proper place and the eye be directed at once to the subject of the picture. His other exhibit is a group rather than a genre study. There is much technical excellence in these two exhibits, which is worthy of better subjects. Highly glazed surfaces, though they show up details very well, do not as a rule contribute anything towards artistic rendering.

Mr. Middlemiss's "Anthropometry" shows a group thoroughly intent upon the business in hand, and the arrangement of the three principal figures is excellent, but we wish the fourth one at the extreme right had been banished. He is evidently not wanted, only about half of his figure in profile is visible, and to our mind the introduction of this figure, where it is, is an error. The spots of whitewash on the background are probably "true to nature" but they should have been toned down at least, if not obliterated. The print is also a trifle flat, but that is probably due to the state of the bromide paper rather than the fault of the operator. The "Portrait" from an untouched negative is a good example of its class, but it possesses no distinctive merit beyond that.

Mr. Michie Smith's "Demonstation of the Röntgen Rays" is a fairly well balanced and well arranged picture. There are however too many strongly marked horizontal and vertical lines, nearly parallel with the edges of the print and with each other. The table is square with the edges of the print, the Rhumkorff coil, and the bench on which the skeleton lies, are square with the table; the book-shelf behind, the books inside it, and the boxes on the top of the shelf—even they do not break this monotony. A slight alteration of the position of the table at least and the objects on it would have thrown most of these lines into better perspective. Otherwise, there is nothing to disturb the repose in this picture. The tone is excellently subdued, though a hypercritical eye would detect the uneven action of a reducer in this print.

Mr. Walker's "Waiting for Inspiration" shows that he had received plenty of that quality before attempting his Figure study. There is little or nothing to complain of in the linear composition. The lighting is bold and inclined to be a little harsh, but it is correctly accentuated, except on the hands which require a little more light. The strong dots of light on the chair and in the window would be better if a little more subdued. The tone of the print is very good and the larger masses of light and shade are well balanced.

We have presumed to offer these critical remarks not in any spirit of fault-finding, but purely in that friendly spirit which has characterised such criticisms hitherto, and which we have reason to believe has been appreciated by competitors at our half-yearly shows.

We are asked to notify that up-country members wishing to see the exhibits can have them sent up on application to the Honorary Secretary.

WE have received from Messrs. Marion & Co., 22, Soho Square, London, a copy of their new catalogue. It is a handsomely got up book, well printed on glazed paper, and lavishly illustrated. A look through its 136 pages quickly convinces one of the choice nature of Messrs Marion & Co.'s stock. Their own plates and films and printing papers are prominently described, in fact the full description which accompanies nearly every illustration is a marked feature of this catalogue. We have placed the book in the Society's Library, from which members can get it out.

Messrs. Percy Lund & Co., Ludgate Circus, London, E.C., have sent us a little volume entitled "Photography for Artists," by Mr. Hector Maclean, President of the "Croydon Camera Club." It is adorned by several illustrations which have been contributed by artists and photographers. The scope of the book will be apparent from the following headings of some of its chapters:—The extent to which photography is used by Artists, concerning various kinds of artists' studies (Landscape, Seascape, Foreground, Figures, Trees, Drapery, Architecture, Moving Objects, Passing Effects, &c.),

Photographic reproductions of works of art, The Photographic misrepresentations of tones, Reasons why artists should use a camera, Choice of apparatus, List of Photographs for artists, &c. These subjects are dealt with in an instructive and pleasant way, and the book is full of suggestion. Artists and photographers cannot fail to derive much valuable information by a perusal of the book, which we have handed over to the Honorary Secretary to be placed in the Library.

A new periodical devoted to the interests of process work has been issued by the Scovill and Adams Company of New York. They have forwarded us a copy of this Journal which is called the "Practical Process Worker." It is excellently printed on toned paper and well illustrated. The "Ebb Tide," one of the "Photograms of the year," forms the frontispiece of the number sent to us. Those wishing to be *au fait* with what is going on in the "Process" world, and with improvements in engraving, and half-tone and other branches of reproduction, will find this latest addition to photographic literature quite worthy of patronage.

Messrs. Harrington and Co., of King Street, Sydney, N. S. W., have forwarded a copy of their catalogue of over 200 pages, which contains as complete a list of photographic goods as one could wish to have within reach. Materials and apparatus are described and illustrated, and the prices of many goods compare favorably with English prices.

THE illustration for the month is a reproduction of an enlargement, which was exhibited at the Society's half-yearly competition in May last year by H. H. Ramah Vurmah, the Elayah Rajah of Travancore.

He calls the picture "In a Brown Study," and he has kindly furnished the following information:—

"The photograph was taken out of doors in diffused light, at about 8 o'clock one bright morning, on an Ilford (white label) half-plate, with a Rapid Rectilinear Doublet Lens, stop *F*/16, and exposure the time required to count 8. It was developed with Hydroquinone—Caustic Potash developer, and the result was a clear and bright negative.

The story of two lovers I had read in my school days in Thomson's "Summer"—'Damon and Musidora'—gave me the initiative for a subject to exercise my knowledge in photography. I had in hand the most suitable requisites. I had got a loan, from a friend of mine, of a very effective scenic background and had also at command one of Kerala's fairest daughters. The result is such as you see "In a Brown Study." It represents a Travancore high-class Nair lady who, after "bathing her fervent limbs in the refreshing stream" and "tasting the lucid coolness of the flood," sits on the grassy bank "robed in loose array" while

> "——through the parted robe, the alternate breast,
> With youth wild throbbing, on the lawless gaze
> In full luxuriance rose."

In her right hand she holds an ivory comb and in the left a hand-mirror. While busy combing her streaming locks and giving herself the finishing touches of her toilet, she falls into a reverie and dreams what sweet words of tender affection were used by her pretty charmer, and what the result would be of a chance-meeting there while she was seated on the bank of the prattling stream

> "——like the Cyprian goddess, Amoret,
> Delicious dressed in rosy-dimpled smiles."

The look of self-satisfaction may be attributed to the prospect of a "surer conquest" of her fond adorer's heart."

STEREOSCOPIC PHOTOGRAPHY WITH A SINGLE LENS.

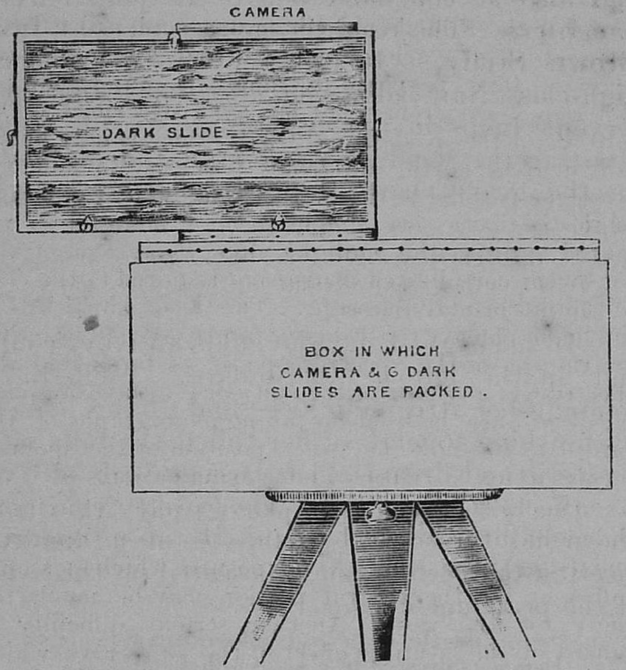
By H. C. R. Harley.

Being asked to describe how I use a single lens for taking stereoscopic pictures I do so, but I am afraid this mode of working is a thing of the past, for with the new improved cameras for the process and the "Stereoscopic transmitters" lately introduced, no one will, I fear, care to try this method.

The camera which I employ is useless for moving objects, or quick work, but it has the advantage of not necessitating transposition of the prints, or division of the negative for making transparencies by contact.

The camera, lens, and six dark slides for plates $6\frac{3}{4}'' \times 3\frac{1}{4}''$ pack into a box $18'' \times 7'' \times 5\frac{1}{2}''$. On the top of this box a grooved piece of sliding board is fixed on a pivot, and along one side of it small holes are drilled half an inch apart. When required for use, this box is screwed on to a camera stand and carefully levelled, the camera (a $5'' \times 4''$ one) is slid on to the sliding board till it is in its centre. If the spacing between the two positions of the lens is to be 3 inches, a peg is fixed in the hole $1\frac{1}{2}$ inches from the centre, and the camera moved, till a catch under it comes against the peg and prevents its going any

further. If this movement has been to the *left*, the *right* end of the dark slide is inserted, and the view which has previously been carefully focussed taken. The sketch shows the camera in this position, with the dark slide inserted.



The shutter of the dark slide being in two pieces, the exposing of half the plate at a time is not difficult. Now move the camera 1½ inches from the centre to the *right*, and insert the *left* end of the dark slide, and expose, due care being taken that both exposures are the same. Prints from negatives so taken require no transposing, and can be trimmed and mounted without being divided.

Two negatives thus taken are sent by post; it will be seen that prints for these require no transposing.

[These negatives were shown at the last meeting.—*Eds.*]

SOLAR PHOTOGRAPHY.

By C. Michie Smith, B.Sc., F.R.S.E., F.R.A.S.

Solar photography is employed mainly for two purposes—for obtaining pictures, day by day, of the spots and faculæ, which are constantly changing, and for recording the phenomena which become visible only on the comparatively rare occasions of total eclipses of the sun. I propose to deal with only the former of these to-night, as the latter will more suitably form the subject of discussion when arrangements are being made to observe our next Indian total eclipse of the sun on January 22nd, 1898.

Before the introduction of photography for the purpose of recording sun-spots, much valuable work had been done by Carrington and others by means of eye observations. The positions of the spots were fixed by actual measurement and the details of the more important spots were sketched in by hand. This work was very laborious, for the details of large spots are usually most complicated, and none but a trained artist need expect to be able to produce a picture of any real value. The sketches are best made from an image of the sun projected on a cardboard disc, and for this purpose any telescope of moderate power can be employed. If we substituted a photographic plate placed in a camera for the screen we would not get a clear photograph, since telescopes intended for visual purposes are not usually corrected for the rays which are most efficient photographically. This is a difficulty which can be got over to a certain extent by finding the actinic focus by experiment and focussing accordingly, and many years ago very fair solar photographs were taken with the 8-inch Troughton and Simms' equatorial of the Madras Observatory during a search for the supposed planet Vulcan. Rutherfurd of New York was probably the first astronomer to make a telescope specially adapted for astronomical photography and he obtained results of a very high class. Rutherfurd's telescope was used simply as a photographic camera with a lens of 13 inches aperture and a focal length of about 16½ feet. But even with this the pictures of the sun were only 1¾ inches in diameter, and it was necessary to enlarge them before the minor details could be seen.

To overcome this difficulty De La Rue, in 1857, designed the instrument known as the "Kew Photoheliograph," of which the instrument which you have seen to-night is the modern form. It is the same in its essential features and hence it is best to describe this form. It consists essentially of a photographic objective of 4 inches aperture and 5 feet focal length and an enlarging lens which throws a magnified image of the sun on the sensitive plate. The lenses and camera are, of course, connected by a tube, and for convenience this tube is mounted equatorially so that it can follow the diurnal course of the sun by a single motion. A driving clock is also provided, which is so adjusted that it would make the telescope turn completely round from east through west to east again in a solar day, and hence if the instrument is pointed to the sun and the clock started it will continue to point to the sun so long as the clock is kept going. This driving clock is by no means essential since the exposures are only a small fraction of a second, but it is a convenience especially in cloudy weather when one has to take advantage of a break in the clouds to get an exposure. In fine weather it is probably best not to use the clock (except when focussing), but to clamp the telescope a little ahead of the sun and make the exposure when the sun reaches the right place. The moment for making the exposure is easily determined by noting where the image of the sun formed by a small lens fixed outside the tube falls on a cross drawn on a piece of paper placed at its principal focus.

To make it possible to determine from the photograph the positions of the spots on the sun it is necessary to have a fiducial line or lines on the plate. In this instrument two spider lines at right angles to each other are stretched across a diaphragm

at the principal focus of the large lens and photographs of these appear on each plate. The exact orientation of these lines can be determined by taking two photographs on the same plate at a short interval of time with the clock stopped. A line joining the two points at which these circles cut each other is evidently at right angles to the direction of motion of the sun's centre on the plate. The direction of the sun's motion is of course known, and hence the directions of the spider lines can be easily determined. Further, the position angle of the sun's axis and the longitude of the sun's centre can be calculated for any given time, and hence if we know the time at which the exposure was made we can, by the help of the lines, place the photograph on the measuring engine with its axis in any required direction, so that the solar latitudes and longitudes of the spots can readily be tabulated.

The shutter used with this instrument is a very rough and, to my mind, unsatisfactory one. It consists of a brass plate in which there is a slit, the width of which can be adjusted by means of a screw. This plate is placed in a slot nearly at the principal focus of the object glass and is actuated by a strong spiral spring. This form of shutter is nearly as old as the instrument and might with advantage be replaced by one of more modern design. Personally I would prefer a shutter which was placed outside the object glass and connected with it only by a black cloth tube which would not conduct the vibration to the instrument. Instruments of the kind I have described are in daily use at Greenwich, Mauritius, and Dehra Dûn, and there are very few days in the year on which photographs of the sun are not obtained at one or other of these places.

Solar photographs are, of course, taken at many other observatories, and at some of these, as at the Lick Observatory, no magnifying lens is used. In such cases it is necessary to have a lens of great focal length if a reasonably large image of the sun is to be obtained. The lens used at the Lick Observato y is of 4) feet focal length, and to simplify the use of such a long camera the arrangements are modified. The telescope, or camera, instead of being mounted on a stand is placed horizontally with what would be the eye end in an ordinary telescope inside a dark room. The image of the sun is reflected into the telescope by what is called a heliostat, which consists of a large plane mirror so mounted and driven by clock-work that the beam of light is reflected in a constant direction. The mirror consists of a disc of unsilvered glass, the two faces being slightly inclined to each other so that the beam of light reflected from the back surface will be thrown quite away from the lens of the telescope. The photograph is in this case taken in the principal focus of the lens and is nearly 4½ inches in diameter. Much is to be said in favour of this form of photo-heliograph, for the magnifying lens is always a source of trouble in the Kew form. The chief difficulty is said to lie in the shutter. Where a narrow slit is used diffraction effects will be produced unless the shutter is placed at the principal focus of the lens. This of course cannot be done exactly with the Lick form of instrument, but a focal-plane shutter might, I think, be so arranged that no sensible injury would be caused to the definition, or a shutter might be used which had a large aperture but moved with a correspondingly high velocity.

For the Kodaikanal Observatory a lens has been ordered of 6 inches aperture and 40 feet focal length. It is proposed to mount it in a somewhat different form from what has been described. The latitude of the Kodaikanal Observatory is only about 10½ degrees north, and hence it is easy to mount a telescope parallel to the earth's axis. The advantage of this is that a very simple form of heliostat is required to direct the sunlight along it, instead of the somewhat complicated instrument required in the case of the horizontal telescope. The Kodaikanal lens is intended chiefly for forming an image of the sun on the slit of the spectroscope so as to enable the spectrum of any part of the sun's disc to be examined, but it will also be used for taking photographs of the sun so as to show the exact position of the spots or faculæ which have been under examination.

One difficulty in solar photography arises from the great difference in brightness between the centre and edge of the sun. An exposure which is amply sufficient for the central portion may be much too short for the rest. Another serious difficulty is caused by the heating effect of the sun's rays which renders the atmosphere unsteady and also changes the focal length and even the shape of the lens. So far as my experience goes, really good solar photographs are very rare though photographs good enough for the measurement of sun-spot areas are common. Personally I am inclined to think that the best photographs will be obtained in the principal focus of a lens of long focal length, but I must say this is by no means the opinion of all astronomers. I hope, however, at Kodaikanal to give both systems a thorough trial under favourable conditions.

I have so far said nothing about the plates to be used, and I regret to say this is a point on which I am not at present able to say anything very definite. At Dehra Dûn and some other places wet plates are still employed, but dry plates are used at Greenwich. The plate to be suitable must be very slow and as fine grained as possible, and it seems probable that some of the plates made for process work would be very suitable The development should be very slow so as to bring out the details of the solar surfa e, which are numerous and very fine, while the differences of brightness are comparatively small.

OUR HOME LETTER.

Like a hardy annual which appears above the ground, flowers, and dies down again; or like an intermittent spring which now flows with full volume, then diminishes to a gentle trickle only to bubble up again in full force, when least expected, the debate on photography and art is almost always with us in some one of its aspects. There are plenty of men left yet,

of the old school, who still ride the dead horse, and swear that in photography there is no art. Professor Baldwin Brown of Edinburgh, who recently lectured on this subject, is not quite so rabidly conservative as others of his school. The position he takes up is to deny perfection to nature. He says that an artist must necessarily make some exaggeration in order to bring the real to the ideal, while not necessarily departing from truth, and a photographer therefore has no claim to that title, because he cannot do the same.

This reminds one of the old story of Zeuxis, the painter of Heraclea, who was the first to discourse on chiaroscuro. He was employed to produce a perfect beauty in the character of Helen for the Temple of Juno, and in order to do this he chose five of the most beautiful damsels the city could produce, and picking out that which was excellent in each, and bringing into play his taste and judgment, from these individual constituents he formed an ideal figure of marvellous grace, elegance, and symmetry.

Now it must be admitted that it is not so easy for the photographer to follow on the lines of Zeuxis as it is for the painter. Nevertheless the human form divine is not in many individuals so serious a failure as one would be led from this story to infer, and it is quite possible to get a model, possessed of sufficient perfection of form and feature, which in right hands would be capable of producing a picture of merit by means of the camera. True it is that with undraped figures the photographer meets with the greatest difficulties, and it is not in this direction that his most successful efforts are produced, but it is also true of painting. The nude should only be attempted by artists of the highest ability, whether photographers or painters. In landscape the photographer's difficulties in respect to selection are greater again than those of the artist, but it cannot be denied that nature is more successful in other directions than she is with the human race. There are reasons for this which it would be out of place however to enter into here. Artists are not sufficiently acquainted with the camera and its capabilities. When they become so, it would be presumptive and absurd to say that their brushes would be thrown aside, but we believe that the camera at least will not be despised and disparaged.

Passing from art to science you will be interested in hearing further progress in investigations with the Röntgen ays. The greatest advance is in the direction of using screens to accelerate the exposure, and several experimenters recommend the use of a screen covered with crystals of barium-platino-cyanide. The dry plate is placed film side against the screen, and the objects to be photographed on the glass side of the plate.* The whole is then placed in the box or light-tight bag, and subjected to the rays from the Crooke's tube in the ordinary way. By this means a full exposure can be obtained in less than two minutes.

Some attempt has been made to prepare plates specially for X rays photography. Messrs. B. J. Edwards and Co. announce a special brand of plates for this purpose, but it cannot be said that progress has gone far in this direction, and doubtless an emulsion specially sensitive to this description of light, or whatever it may be, will be available for the experimenter before long. From a long series of experiments made by Battelli and Garbasso, two Italian scientists, on the varying transparency of different substances to the X rays, it is found that mercury, palladium, lead, silver, bismuth, and copper have the greatest density, while wood, celluloid, ebonite, aluminium, and various other substances, are among the most transparent. A new field of investigation has been opened by M. Henri Becquerel, who finds that several phosphorescent substances give off rays which will penetrate opaque objects.

A means has been found of displaying the Kinetoscope, Edison's invention, through the optical lantern, and this form of exhibition is at present popular in many of our Music Halls.

A somewhat heated discussion has taken place between two of our most prominent experimenters in colour photography, Mr. F. E. Ives and Mr. B. J. Edwards, as to their respective claims to the invention of a camera designed to take photographs in colours. It is difficult to say to which of them belongs the right of priority, but so far as the invention is concerned, there is no doubt they have got a long way towards success. Mr. Edwards tells me that he feels quite sure that before very long it will be possible for the photographer to ask his client whether the portrait shall be in monochrome or in colour, and that practically the one shall be no more troublesome in accomplishment than the other.

MATHEW SURFACE.

* [Ordinary glass plates containing lead are found to be practically opaque to X rays and are therefore unsuitable for use with fluorescent screens. Sensitised films can however be used instead of glass plates—*Eds.*].

PROCEEDINGS OF THE SOCIETY.

Monthly Meeting, held at the Observatory, Nungumbaukum.

Friday, June 5th, 1896.

Mr. F. Dunsterville, President, *in the chair.*

The minutes of the previous meeting having been circulated to members, in the last issue of the Journal, were taken as read and were confirmed.

As Mr. Michie Smith was desirous of giving his demonstration before the disappearance of daylight, he asked that other business might give way; and accordingly the meeting adjourned to the observing shed in which the photo-heliograph was mounted. Mr. Michie Smith then explained the various parts of the instrument and their functions, their advantages and disadvantages. He further explained the nature of the instrument which is to be mounted at the new observatory of Kodaikanal, on the Palani Hills. After Mr. Michie Smith had answered the questions of members, the further business of the meeting was proceeded with. His paper on Solar Photography was taken as read and will be found among the original matter in this Journal.

The Honorary Secretary communicated a notice of the photographic convention of the United Kingdom to be held at Leeds in next July, under the presidentship of H. P. Robinson, Esq. Members going home presently can join by paying 5 shillings. He also read letter from Mr. Maennig, offering the use of his dark room to members who may happen to visit Tranquebar, and his offer was accepted with many thanks.

PROPOSAL OF NEW MEMBERS.

Capt. Thomas proposed and Mr. J. L. Walker seconded—

R. F. Cox, Esq., 19th Hussars.

Mr. Michie Smith proposed and Surgeon-Major VanGeyzel seconded—

W. A. Willock, Esq., I. C. S.

Mr. Michie Smith proposed and Mr. Phipps seconded—

F. R. Watson, Esq., Bank of Madras.

The President proposed and Surgeon-Major VanGeyzel seconded—

H.E. Sir Arthur Havelock, Governor of Madras, to be members of the Society, and they were duly elected.

The President intimated that H.E. The Governor Sir Arthur Havelock had graciously consented to be a patron of the Society.

THE QUESTION BOX.

What is the best substance for dyeing a plate for photographing clouds through yellow glass?

One of the yellow aniline dyes was suggested.

It was remarked that an isochromatic plate would answer the purpose.

PICTURES FOR THE DAY.

Several "Interiors" were exhibited by General Wardrop, Messrs. Chatterton, Blaker, Walker, Michie Smith and VanGeyzel.

NEXT MEETING.

The Picture Subject will be "A Water Scene." A demonstration of the platinotype printing process at next meeting was promised by one of the members.

MISCELLANEOUS EXHIBITS.

Surgeon-Major VanGeyzel exhibited prints and negatives of surgical injuries to bone taken by him by means of the X rays. He also showed a number of prints on various papers which had been toned in the combined toning and fixing bath and had been in his possession for about two years. Some of these prints had been done by workers above suspicion in their ability to turn out first-class work. The prints were on Solio, P.O.P., Venus, Albumen paper, Matt Solio,—all of which had been toned in the combined bath, and every one of which was now nearly as yellow as a guinea and mostly faded. He further showed two platinotype prints which had been sent to him from home, a year ago, toned with Packham's Catechu powder. The prints when received were exhibited at the Society's meeting and were of a fine sepia tone. They are now almost black and white, showing that the colour deposit obtained by Catechu toning was fugitive.

Some novelties, kindly sent to the meeting by Messrs. W. E. Smith & Co., of Mount Road, were exhibited: a very convenient plate holder which enables the plate to be lifted out of the developer without the necessity of touching it, a new metal printing frame, a dark room bottle rack, and a folding camp non-actinic lamp. They are the manufacture of Messrs. Butcher and Sons of Blackheath and are distinctly novel acquisitions.

A hearty vote of thanks to Mr. Michie Smith for inviting the Society to meet at his Observatory and for the instructive demonstration which he gave was passed unanimously.

The usual vote of thanks to the Chairman closed the meeting.

HALF-YEARLY COMPETITION.

MAY 1896.

Subject: A FIGURE OR GENRE STUDY.

No.	Title.	Exhibitor's Name.	Judges' Awards and Remarks.
Large Pictures (8½″ x 6½″ and upwards).			
1	Anthropometry ...	C. S. MIDDLEMISS, Esq. ...	Silver Medal.
2	A Demonstration of Röntgen Rays.	C. MICHIE SMITH, Esq. ...	Bronze Medal.
Small Pictures (smaller than 8½″ x 6½″).			
1	A Portrait	C. S. MIDDLEMISS, Esq.	
2	Tea Party	E. MAENNIG, Esq.	
3	Portrait	E. MAENNIG, Esq.	
4	"Am I Not Pretty" ...	H.H. THE ELAYA RAJAH OF TRAVANCORE.	
5	A Portrait Study ...	H.H. THE ELAYA RAJAH OF TRAVANCORE.	
6	A Promenade ...	H.H. THE ELAYA RAJAH OF TRAVANCORE.	
7	Mahroussa	F. H. D. PINSENT, Esq. ...	Posing shows good taste, but printing of all of them leaves much to be desired.
8	Seta	F. H. D. PINSENT, Esq. ...	Posing shows good taste, but printing of all of them leaves much to be desired.
9	Norma	F. H. D. PINSENT, Esq. ...	Posing shows good taste, but printing of all of them leaves much to be desired.
10	Maiden Meditation ...	F. H. D. PINSENT, Esq. ...	Posing shows good taste, but printing of all of them leaves much to be desired.
11	Dorothy	F. H. D. PINSENT, Esq. ...	Posing shows good taste, but printing of all of them leaves much to be desired.
12	The Orphan	F. H. D. PINSENT, Esq. ...	Posing shows good taste, but printing of all of them leaves much to be desired.
13, 14	The First Shot ...	Col.-Sergeant STEPHEN BLAKER.	Certificate of Merit.
15, 16, 17	After The Match ...	Col.-Sergeant STEPHEN BLAKER.	Certificate of Merit.
18	Waiting for Inspiration..	J. L. WALKER, Esq. ...	Bronze Medal.

CORRESPONDENCE.

THE EDITOR OF THE JOURNAL,

Amateur Photographic Society of Madras.

DEAR SIR,—On page 62 of the Journal for May you are kind enough to mention, with approval, the small publication with Exposure Tables compiled by me.

Will you kindly permit me to say that the Exposure Tables are all I have any claim to, the remainder of the volume being the work of Mr. W. H. Oakes.

As I am in no way pecuniarily interested in the sale of the Exposure Tables, you may perhaps allow me to observe that Messrs. Oakes and Co. will shortly issue them in a very handy form on cardboard.

ROYAPURAM, *21st May 1896.* — Yours faithfully, FRED. DUNSTERVILLE.

For the Question Box.

1. Would any one who has used a half-plate size Hand Camera give his experiences. Is it too big and heavy for use in the hand with that ease and readiness which Hand Camera subjects often demand ?

2. Does a ½ plate R. R. lens, of say 8½ inch focus, give practically enough of 'depth of focus'—in focussing automatically by scale in Hand Camera work ?

3. Are Exposure Meters easy to use and quite reliable ? Do sensitive strips or discs of paper for use therewith keep well in this country ? Are meters that are constructed to work without the use of sensitive tissue, reliable and accurate. What is the best Exposure Meter for India ?

ANONYMOUS.

[The above was received too late for the Question Box at last meeting. As the Question Box is only for the use of members of the Society, they ought invariably to sign their names on the question paper sent to the Secretary, who will of course not divulge the names of the questioners.—*Eds.*]

EXTRACT.

COLOUR PHOTOGRAPHY.

The scientific event of last week was the description and demonstration of colour photography given by Prof. Lippmann before the Royal Society. On the occasion of the centenary celebration of the Institute of France last year, Lord Kelvin invited Prof. Lippmann to give the Royal Society an account of his researches on photography in colours, and last Thursday's meeting was the result. The methods employed by Prof. Lippmann are well known among men of science, but few of the Royal Society were prepared to see such remarkable results as those obtained and exhibited by the distinguished French physicist. The honour and fine feeling which such visits bring to the Society, and the extreme interest aroused, should help to make similar occasions of more frequent occurrence. We print Prof. Lippmann's lecture below, and our only regret is that it cannot give an at all adequate conception of the striking achievement with which it deals.

The problem of colour photography is as old as photography itself. The desire of fixing the colours as well as the design of the beautiful image thrown on the screen of the camera, very naturally occurred to the earliest observers. Since the beginning of this century three distinct solutions of the problem have been realised.

The first solution, not quite a complete one, is founded on the peculiar properties of a silver compound, the violet subchloride of silver. E. Becquerel (1860) converted the surface of a daguerreotype plate into this silver compound, and by projecting on it the image of the solar spectrum, and other objects, obtained good coloured impressions. Poitevin substituted paper for the silver plate as a substratum. No other substance has been discovered that can play the part of the subchloride of silver. Moreover the image is not fixed, in the photographic sense of the word; that is, the coloured impression is retained for any length of time in the dark, but it is blotted out by the action of daylight. The reason of it is this: the Becquerel images are formed by coloured silver-compounds, which remain sensible to light; so that they are destroyed by the continued action of light, in virtue of the same action which gave them birth. Despite the numerous experiments made by Becquerel, Poitevin, Zenther, and others, no substance has been found that is capable of destroying the sensibility of the subchloride for light without at the same time destroying its colour.

The second method for colour photography is an indirect one, and may be called the three-colour method. It was invented in France by Ch. Cros, and at the same time by M. Ducos du Hauron (1869). German authorities claim the priority of the idea for Baron Bonstetton. Three separate negatives (colourless) are taken of an object through three coloured screens. From these three positives (equally colourless) are made; and, lastly, the colour is supplied to these positives by means of aniline dyes or coloured inks. Thus three coloured monochromatic positives are obtained, which by superposition give a coloured image of a model. In the ingenious process lately invented by Prof. Joly, the three negatives, and apparently the corresponding three positives, are obtained interwoven on one and the same plate. The three-coloured method can give a very good approximation to the truth, and has probably a great future before it. We may call it, nevertheless, an indirect method, since the colours are not generated by the action of light, but are later supplied by the application of aniline dyes or other pigments. Moreover, the choice of the pigments, as well as of the coloured screens through which the negatives have been obtained, is in some degree an arbitrary choice.

The third and latest method by which colour photography has been realised is the interferential method, which I published in 1891, and the results of which I beg to lay before you this evening. It gives fixed images, the colours of which are due to the direct action of the luminous rays.

For obtaining coloured photographs by this method, only two conditions are to be fulfilled. We want (1) a transparent grainless photographic film of any kind, capable of giving a colourless fixed image by the usual means; and (2) we want a metallic mirror, placed in immediate contact with the film during the time of exposition.

A mirror is easily formed by means of mercury. The photographic plate being first enclosed in a camera-slide, a quantity of mercury is allowed to flow in behind the plate from this small reservoir, which is connected with the slide by a piece of india-rubber tubing.[1] The slide is then adapted to the camera, and the action of light allowed to take place. After exposure the slide is separated from the camera, the mercury reservoir lowered so as to allow the mercury to flow back into it; the photographic plate is then taken out, developed and fixed. When dry, and examined by reflected light, it appears brilliantly coloured.

The sensitive film may be made either of chloride, iodide, or bromide of silver, contained in a substratum either of albumen, collodion, or gelatine. The corresponding developers, either acid or alkaline, have to be applied; the fixation may be cyanide or bromide of potassium. All these processes I have tried with success. For instance, the photograph of the electric spectrum now projected before your eyes has been made on a layer of gelatino-bromide of silver, developed with amidol, and fixed with cyanide of potassium.

As you see, bright colour photographs may be obtained without changing the technique of ordinary photography; the same films, developers and fixators have to be employed; even the secondary operations of intensification and of isochromatisation are made use of with full success. The presence of the mirror behind the film during exposure makes the whole difference. From a chemical point of view nothing is changed, the result being a deposit of reduced silver left in the film, a brownish, colourless deposit. And yet the presence of a mirror during exposure causes the colourless deposit to show bright colours. Of course we want to know how this is done; we require to understand the theory of those colours.

We all know that colourless soap-water gives brilliant soap-bubbles; the iridescence of mother-of-pearl takes birth in colourless carbonate of lime; the gorgeous hues of tropical birds are simply reflected from the brownish substance which forms the feathers. Newton discovered the theory of these phenomena, and subjected them to measurement; he invented for the purpose the experiment called by the name of Newton's rings. Newton showed,

1 The glass of the photographic plate has to be turned towards the objective, the film in contact with the metallic mirror.

as you know, that when two parallel reflecting surfaces are separated by a very short interval, and illumined by white light, they reflect only one of the coloured rays which are the constituents of white light. If, for instance, the interval between the reflecting surface is only $\frac{2}{10000}$ of a millimetre, violet rays are alone reflected, the rest being destroyed by interference; that is, the two surfaces send back two reflected rays whose vibrations interfere with one another, so as to destroy every vibration except that which constitutes violet light. If the interval between the reflecting surfaces be augmented, $\frac{3}{10000}$ of a millimetre, the destruction of vibration takes place for every vibration except that of red light, which alone remains visible in this case.

If we consider now this photograph of the spectrum, and especially the violet end of the image, we find that this is formed by a deposit of brown reduced silver. In the case of an ordinary photograph, this deposit would simply be a formless cloud of metallic particles; here the cloud has a definite, stratified form; it is divided into a number of thin, equidistant strata, parallel to the surface of the plate, and $\frac{2}{10000}$ of a millimetre apart. These act as the reflecting surfaces considered by Newton, and as they are at the proper distances for reflecting violet rays, and these alone, they do reflect violet rays.

The red extremity of the photograph is equally built up of strata which act in a like manner; only their distance intervals here amount to $\frac{3}{10000}$ of a millimetre, and that in the proper interval for reflecting red light. The intermediate parts of the spectral image are built up with intermediate values of the interval, and reflect the intermediate parts of the spectrum.

The appearance of colour is therefore due to the regular structure above described, imprinted on the photographic deposit. The next question is—How has this very fine, peculiar, and adequate structure been produced?

It is well known that a ray of light may be considered as a regular train of waves propagated through the ether, in the same way as waves on the surface of water. The distance between two following waves is constant, and termed the wave-length; each sort of radiation, each colour of the spectrum, being characterised by a particular value of the wave-length. Now, when a ray of light falls on a sensitive film, this train of waves simply rushes through the film with a velocity of about 300,000 kilometres per second; it impresses the film more or less strongly, but leaves no record of its wave-length, of its particular nature or colour, every trace of its passage being swept out of form by reason of its swift displacement. The impression therefore remains both uniform and colourless. Things change, however, as soon as we pour in mercury behind the plates, or otherwise provide for a mirror being in contact with it. The presence of the *mirror* changes the propagated waves into *standing* waves. The reflected ray is, namely, thrown back on the incident ray, and interferes with its motion, both rays having equal and opposite velocities of propagation. The result is a set of standing waves—that is, of waves surging up and down each in a fixed plane. Each wave impresses the sensitive film where it stands, thus producing one of these photographic strata above alluded to. The impression is latent, but comes out by photographic development. Of course the distance between two successive strata is the distance between two neighbouring waves; this, theory shows, is exactly half the wave-length of the impressing light. In the case of violet, for instance, the wave-length being $\frac{4}{10000}$ millimetres; half the wave length in the above quoted distance of $\frac{2}{10000}$ millimetres; this, therefore, is at the same time the interval between two standing waves, in the case of violet light, the interval between two successive photographic strata, and at last it is the interval required to exist, according to Newton's theory, for the said strata reflecting violet rays, and making these alone apparent, when illumined by white light.

The colours reflected by the film have the same nature and origin as those reflected by soap-bubbles or Newton's rings; they owe their intensity to the great number of reflecting strata. Suppose, for instance, the photographic film to have the thickness of a sheet of paper (one-tenth of a millimetre), the fabric built in it by and for a violet ray is five hundred stories high, the total height making up one-tenth of a millimetre. Lord Rayleigh, in 1887, has proved *à priori* that such a system is specially adapted to reflect the corresponding waves of light.

How are we now to prove that the above theory is really applicable to the colour photograph you have seen? How can we demonstrate that those bright colours are due not to pigments, but to the interference, as in the case of soap-bubbles? We have several ways of proving it.

First of all, we are not bound to the use of a peculiar chemical substance, such as Becquerel's subchloride of silver; we obtain colours with a variety of chemicals. We can, for instance, dispense entirely with the use of a silver salt; a film of gelatine or coagulated albumen impregnated with bichromate of potash, then washed with pure water after exposure, gives a very brilliant image of the spectrum.

Secondly, the colours on the plate are visible only in the direction of specular reflection. The position of the source by which we illumine the photograph being given, we have to put the eye in a corresponding position, so as to catch the regularly reflected rays. In every other position we see nothing but a colourless negative. Now, as you are aware, the colours of pigments are seen in any direction. By projecting again a photograph of the spectrum, and turning it to and fro, I can show you that the colours are visible only in one direction.

Thirdly, if we change the incidence of the illuminating rays, that is, if we look at the plate first in a normal direction, then more and more slantingly, we find that the colours change with the incidence exactly as they do in the case of soap-bubbles, or of Newton's rings; they change according to the same law, and for the same reasons. The red end of the spectrum turns successively to orange, yellow, green, blue, and violet. The whole system of colours, image of the spectrum, is seen to move down into the part impressed by the infra-red. This is what we expect to happen with interference colours, and what again we cannot obtain with pigments.

Fourthly, if while looking at the film normally, we suffer it to absorb moisture—this can be done by breathing repeatedly on its surface—we see that the colours again change, but in an order opposite to that above described. Here the blue end of the spectrum is seen to turn gradually green, yellow, orange, red, and finally infra-red, that is, invisible. The spectrum this time seems to move up into the ultra-violet part of the improved film. By suffering the water to evaporate, the whole image moves back into its proper place; this experiment may be repeated any number of times.

The same phenomenon may be obtained with Newton's apparatus, by slowly lifting the lens out of contact with the plane surface. The explanation is the same in both cases. The gelatine swells up when imbibing moisture. If we consider, for instance, the violet of the spectrum, the small intervals between the strata, corresponding to violet rays, gradually swell up to the values proper for green, and for red, and for infra-red; green, then red, then infra-red, ars therefore successively reflecteli.

We will wet this photograph of the spectrum with water, project it on the screen, and watch the colours coming back in the order prescribed by theory.

It is necessary to use a transparent film since an opaque one, such as is commonly in use, would hide the mirror from view; the sensitive substance must be grainless, or, at least, the grains must be much finer than the dimensions of the strata they are intended to form, and therefore wholly invisible. The preparation of transparent layers gave me at first much trouble; I despaired for years to find a proper method for making them. The method, however, is simply thus: if the sensitive substance (the silver bromide, for instance) be formed in presence of a sufficient quantity of organic matter, such as albumen, gelatine, or collodion, it does not appear as a precipitate; it remains invisible; it *is* formed, but seems to remain dissolved in the organic substratum. If, for instance, we prepare a film of albumeno-iodide in the usual way, only taking care to lessen the proportions of iodide to half per cent. of the albumen, we get a perfectly transparent plate, adapted to colour photography.

We want now to go a step further. It is very well for physicists to be contented with working on the spectrum, since that contains the elements of every compound colour; but we all desire to be able to photograph other objects than the spectrum—common objects with the most compound colours. We have again but to take theory as a guide, and that tells us that the same process is able to give us either simple or compound colours. We have then to take a transparent and correctly isochromatised film, expose it with its mercury backing, then develop and fix it in the usual way; the plate, after drying, gives a correct coloured image of the objects placed before the camera. Only one exposure, only one operation is necessary for getting an image with every colour complete.

A plausible objection was offered at first to the possibility of photographing a mixture of simple colours. The objection was this: a ray of violet gives rise to a set of strata separated by a given interval; red light produces another set of strata with another interval; if both co-exist, the strata formed by the red

are sure to block out here and there the intervals left between the strata formed by the violet. Is it not to be feared that one fabric will be blurred out by the other, and the whole effect marred? The confusion would be still worse if we consider the action of white light, which contains an infinity of simple components; every interval here is sure to be blocked up.

Mathematical analysis, however, shows this objection to be unfounded; we have great complexity, but not confusion. Every compound ray, both coloured and white, is faithfully rendered. As an experimental proof of this, we will project on the screen photographs of very different objects, namely, stained-glass windows, landscapes from nature, a portrait made from life, and vases and flowers.

That the colours here observed are due to interference, and not to the presence of pigments, can be shown in the same way as with the spectrum. Here, again, we observe that the colours are visible only in the direction of specular reflection, that they change with the angle of incidence, that they change and disappear by wetting, and reappear by drying. Pigments remain equally visible and unaltered in colour under every incidence. If we attempted to touch up one of our photographs with oil or water-colours, the adulterated place would stand out on a colourless background by merely obscuring by diffused light. It is therefore impossible either to imitate or touch up a colour photograph made by the above described interferential method.—*Nature.*

List of Members whose Dark Rooms are available for use by Members of the Madras Amateur Photographic Society.

J. L. VanGeyzel, Dare's Gardens, Chetput.

J. L. Walker, Holloway's Gardens, Pantheon Road.

T. P. S. Nagaratnam, 47, Malayappen Street, Black Town.

A. Chatterton, College of Engineering, Chepauk.

Surg.-Col. P. H. Benson, Mysore.

E. Meannig, Buckingham House, Tranquebar.

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For Sale.—20 Volumes, 3 to 22, 1886 to 1895 inclusive, unbound, of "The Amateur Photographer"; these contain a variety of useful information for amateurs.

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